PATENT ABSTRACTS OF JAPAN

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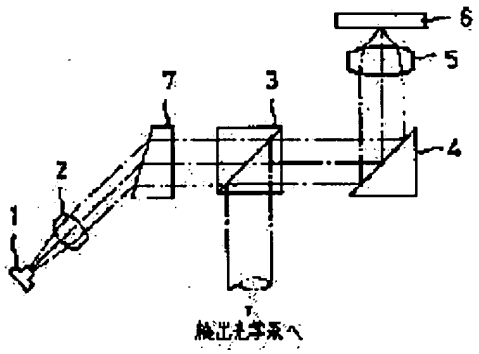
(54) OPTICAL PICKUP DEVICE

(57)Abstract:

PURPOSE: To eliminate the need of excess optical power in the case of erasing without lowering the resolution of an information bit at the time of reproduction even though a light spot has astigmatism by making the light spot on a recording medium an elliptic spot respectively having a major axis or a minor axis in the track direction at the time of erasing and reproducing a record.



CONSTITUTION: A light beam projected from a light source 1 passes through a collimator lens 2, is circularly shaped by a shaping prism 7 in terms of a beam cross-sectional shape, passes through a beam spliter 3, is bent by a deflecting prism 4 in terms of an optical path, and forms the light spot on the surface of the recording medium through an objective lens 5. The reflected light reversely advances so as to be reflected by the beam spliter, and is made incident on a detecting optical system, so that an information signal, a track error signal, a focusing signal, and a focusing error, signal, etc., can be obtained. As to the light spot having the astigmatism; the spot on the medium 6 is controlled to become the elliptic spot having the major axis or the minor axis in the track direction in the case of erasing or reproducing the information. Thus, the excess light is not required to irradiate an adjacent track in the case of erasing and the resolution of the information bit is improved in the case of reproducing.

LEGAL STATUS

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[Date of sending the examiner's decision of rejection]	26.06.2001
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	
[Date of registration]	
[Number of appeal against examiner's decision of rejection]	
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CLAIMS

[Claim(s)]
[Claim 1] A beam plastic surgery means to operate the light beam from the light source orthopedically, and the condensing optical system for condensing to the storage which can rewrite the light beam which passed through this beam plastic surgery means, An optical separation means to separate the reflected light in said record medium which received the light beam from this condensing optical system, and the light beam from said light source, The detection optical system which detects the information recorded on said storage based on the reflected light separated here, At the time of storage elimination of the information on said record medium, so that the optical spot to said record-medium top may turn into an ellipse spot which has a major axis in the direction of a truck It is optical pickup equipment characterized by having the focal control means which is controlled and is controlled to become the ellipse spot to which the optical spot to said record-medium top has a minor axis in the direction of a truck at the time of playback of the information on said storage.
[Claim 2] It is optical pickup equipment according to claim 1 which carries out focal control at the time of storage elimination of the information on said record medium so that the amplitude of a truck error signal may serve as max by said focal control means, and is characterized by carrying out focal control of the time of playback of the information on said record medium so that the amplitude of a PURIPITTO signal or a data signal may serve as max by said focal control means.
[Claim 3] A beam plastic surgery means to operate the light beam from the light source orthopedically, and the condensing optical system for condensing to the record medium which can rewrite the light beam which passed through this beam plastic surgery means, An optical separation means to separate the reflected light in said record medium which received the light beam from this condensing optical system, and the light beam from said light source, The detection optical system which detects the information recorded on said record medium based on the reflected light separated here, Optical pickup equipment characterized by having the focal control means controlled so that the optical spot on said record medium turns into an ellipse spot which has a major axis in the direction of a truck at the time of direct seeking of said condensing optical system.
[Claim 4] Optical pickup equipment according to claim 3 characterized by carrying out focal control so that the amplitude of a truck error signal may serve as max by said focal control means.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the optical pickup equipment which used semiconductor laser as the light source.
[0002]
[Description of the Prior Art] As shown in drawing 10 , the optical pickup equipment which writes in or reads information to a storage makes parallel light the light beam from the light source 1 with a collimate lens 2, and is irradiating the record medium 6 through a beam splitter 3, a polarizing prism 4, and an objective lens 5. Generally as the light source in this case, semiconductor laser is used.
[0003] As semiconductor laser SL as such the light source 1 is shown in drawing 11 , whenever [angle-of-divergence / of the light beam which carries out outgoing radiation in the perpendicular direction theta 1 and the level direction theta 2] differ to a joint, and the direction theta 2 where the perpendicular direction theta 1 is level at a major axis serves as an ellipse beam of a minor axis. Therefore, if it condenses with common optical pickup equipment as shows this light beam to drawing 10 R> 0, the optical spot on a record medium 6 will also turn into an ellipse spot.
[0004] When the major axis of an ellipse spot is in agreement in the direction of a truck of a record medium 6, the fall of resolution to an information pit is caused and information cannot be read with a sufficient precision. Moreover, when the minor axis of an ellipse spot was in agreement with the direction of a truck and it is going to record data on the Nth truck as shown, for example in drawing 12 , even in the N-1st trucks, or the N+1st and a rack, an optical spot will reach, a light beam will be irradiated even on the N-1st [these] trucks and the N+1st trucks which are unrelated to record, and excessive optical power is needed.
[0005] Then, generally [in order to avoid this] the beam plastic surgery which operates an ellipse beam orthopedically with a circular beam is performed. The example is shown in drawing 13 . (a) of drawing 13 shows plastic surgery of the level direction of a light beam, and (b) of drawing 13 shows plastic surgery of a perpendicular direction. Water square theta2 of a light beam expand the path a of an parallel light beam for the light beam obtained from the light source 1 through the collimate lens 2 as shown in (a) of drawing 13 to Path b with two prism 7A and 7B. At this time, a beam plastic surgery scale factor serves as A=b/a. On the other hand, as shown in (b) of drawing 13 , a vertical parallel light beam goes Prism 7C and 7D straight on, and the path c of an parallel light beam does not change before and behind Prism 7C and 7D. It is determined that the scale factor of beam plastic surgery will serve as b=c. The field spot on the record medium 6 of the optical system which performed beam plastic surgery is carried out in this way, and a circular spot will be obtained if the adjustment is fitness.
[0006]
[Problem(s) to be Solved by the Invention] However, if the adjustment in the case of beam plastic surgery shifts, fault which is described below will occur. If the scale factor of beam plastic surgery is now set to A, the focal distance fc of a collimate lens 2 will become equivalence for the horizontal focal distance to have become A*fc. A vertical focal distance is still fc. Therefore, when spacing of the light

source 1 and a collimate lens 2 shifts from a proper value, as shown in drawing 14 , the astigmatic difference will be produced and astigmatism will occur at an optical spot. Here, spacing of the location which was able to be most extracted in the x directions as the astigmatic difference, and the location which was able to be most extracted in the direction of y is said. The value of the astigmatism of the optical spot of record-medium 6 top face to the gap with the light source 1 and a collimate lens 2 is shown in Table 1. This table shows the case where the focal distance of 2.3 times and an objective lens is set [the focal distance of a collimate lens 2] to 4mm for 8mm beam plastic surgery scale factor.
[0007]
[Table 1]

光源とｺﾘﾒｰﾄﾚﾝｽﾞの間隔の適正値からのずれ（μm）	0	2	4	6	8	10
ﾃﾞｨｽｸ上の非点隔差量（μm）	0	0.41	0.811	1.22	1.622	2.03

[0008] On a record medium 6, the 0.5-1.5-micrometer astigmatic difference arises only by several micrometers spacing of the light source 1 and a collimate lens 2 shifting as it understands from now on. Astigmatism occurs at the optical spot on a record medium 6, and since the generating direction is the direction of a truck, it causes the fall of resolution to an information pit, and it becomes impossible that is, to read information with a sufficient precision, if spacing of the light source 1 and a collimate lens 2 shifts. A gap of spacing of the light source 1 and a collimate lens 2 is surely produced in aging, environmental temperature change, etc.
[0009] Therefore, even if the purpose of this invention has astigmatism in the optical spot on a record-medium side, it offers the optical pickup equipment which the resolution of an information pit does not fall at the time of informational playback, and does not need excessive optical power at the time of record elimination.
[0010]
[Means for Solving the Problem] A beam plastic surgery means by which the optical pickup equipment of this invention operates the light beam from the light source orthopedically, The condensing optical system for condensing to the record medium which can rewrite the light beam which passed through this beam plastic surgery means, An optical separation means to separate the reflected light in the record medium which received the light beam from this condensing optical system, and the light beam from the light source, The detection optical system which detects the information recorded on the record medium based on the reflected light separated here, At the time of record elimination of the information on a record medium, while controlling so that the optical spot to a record-medium top turns into an ellipse spot which has a major axis in the direction of a truck It has the focal control means controlled so that the optical spot to a record-medium top turns into an ellipse spot which has a minor axis in the direction of a truck at the time of playback of the information on a record medium.
[0011]
[Function] It controls at the time of record elimination of the information on a record medium so that the optical power from the light source may be used effectively and the optical spot to a record-medium top turns into an ellipse spot which has a major axis in the direction of a truck, and in order to raise the precision of the data to read, on the other hand, it controls by the optical pickup equipment of this invention at the time of playback of the information on a record medium so that the optical spot to a record-medium top turns into the ellipse spot which has a minor axis in the direction of a truck. Thereby, even if astigmatism is on a record-medium side, the resolving power of an information pit does not fall at the time of reading of information, an excessive light source output is not needed at the time of record elimination, but record of efficient data, playback, and elimination are performed.
[0012]

[Example] Hereafter, one example of this invention is explained. Drawing 1 shows the block diagram of the optical pickup equipment of this invention. First, let the light beam which came out of the light source 1 be parallel light with a collimate lens 2. The light beam made into parallel light is orthopedically operated circularly in a collimated beam cross-section configuration by the beam plastic surgery prism 7 which is a beam plastic surgery means. And beam PURITTA 3 which is an optical separation means is passed, and it is inputted into the polarizing prism 4 of condensing optical system. In a polarizing prism 4, a right angle bends an optical path mostly and it irradiates on the recording surface of the rewritable record medium 6 with an objective lens 5. On the 6th page of a record medium, an optical spot from which a diameter becomes the circle which is about 1 micrometer is formed.
[0013] And it becomes parallel light again through an objective lens 5, and it reflects with a polarizing prism 4, it reflects by beam PURITTA 3, and the light beam which reflected the record medium 6 results in detection optical system, such as an information signal, a truck error signal, a focal signal, and a focal error signal. That is, the reflected light in a record medium 6 and the light beam from the light source 1 are separated by the beam splitter 3 which is an optical separation means, and the reflected light from a record medium 6 is inputted into the detection optical system which detects the information memorized by the record medium.
[0014] As mentioned above in the optical system using beam plastic surgery here, since it is surely generated with aging or environmental temperature, a gap of spacing of the light source 1 and a collimate lens 2 performs the following control by the focal control means by this invention in order to prevent the effect by the astigmatism of the spot on the medium 6 by gap of this spacing.
[0015] To an optical spot with astigmatism, at the time of record elimination of the information on a record medium 6, to be shown in drawing 2 , it controls so that the optical spot to a record-medium 6 top turns into an ellipse spot which has a major axis in the direction of a truck. By carrying out like this, irradiating an excessive light on the truck which adjoins a record medium 6 in case record elimination of the data is carried out is lost, and the light beam from the light source 1 can be used efficiently.
[0016] Next, drawing 3 shows the relation of an optical spot and truck 6A of a record medium 6 with astigmatism, and, as for drawing 3 <a>, drawing 3 <c> shows the case where the minor axis of an optical spot is located in the direction of a truck when the major axis and minor axis of an optical spot shift for a while and are located [as opposed to / when the major axis of an optical spot is located in the direction of a truck / the direction of a truck], respectively, as for drawing 3 <b>. and drawing 4 -- <a><b <c>> -- drawing 3 -- the magnitude of the amplitude of each truck error signal of <a><b <c>> which carried out optical spot location ****** is shown. When an optical spot is able to extract in the truck rectangular cross direction most so that drawing 3 and drawing 4 may show (i.e., when the major axis of an ellipse spot becomes in the direction of a truck), the amplitude of a truck error signal serves as max.
[0017] Therefore, before carrying out record elimination of the information at a record medium 6, the monitor of the truck error signal is carried out applying offset to a focal error signal, the offset value of a focal error signal is held in the place where the amplitude of a truck error signal serves as max, and record elimination is performed in the state of the focus. It comes to be shown in related drawing 5 R> 5 of the record medium 6 in this case, an objective lens 5 and the truck rectangular cross direction beam 8, and the direction beam 9 of a truck.
[0018] On the other hand, to an optical spot with astigmatism, at the time of playback of the information on a record medium 6, to be shown in drawing 6 , it controls so that the optical spot to a record-medium 6 top turns into an ellipse spot which has a minor axis in the direction of a truck. When reproducing the information on a record medium 6 by carrying out like this, the resolution of an information pit improves and it becomes it can be accurate and reproducible [information].
[0019] next, drawing 7 -- <a><b <c>> -- drawing 3 -- the magnitude of the amplitude of the PURIPITTO signal corresponding to an optical spot with each astigmatism of <a><b <c>> -- being shown -- the same -- drawing 8 -- <a><b <c>> -- drawing 3 -- the magnitude of the amplitude of the data signal corresponding to an optical spot with each astigmatism of <a><b <c>> is shown.
[0020] As shown in these drawings, when an optical spot is able to extract in the direction of a truck

most (i.e., when the minor axis of an ellipse spot becomes in the direction of a truck), the amplitude of a PURIPITTO signal or a data signal serves as max.

[0021] Therefore, before carrying out record elimination of the information at a record medium 6, the monitor of a PURIPITTO signal or the data signal is carried out applying offset to a focal error signal, the offset value of a focal error signal is held in the place where the amplitude of a PURIPITTO signal or a data signal serves as max, and record playback is performed in the state of the focus. The relation between the record medium 6 in this case, an objective lens 5 and the truck rectangular cross direction beam 8, and the direction beam 9 of a truck comes to be shown in drawing 9 .

[0022] Moreover, at the time of direct seeking of condensing optical system, it controls when moving an objective lens 5 to the truck which a record medium 6 should carry out record playback, namely, so that the optical spot on a record medium 6 turns into an ellipse spot which has a major axis in the direction of a truck. Before carrying out direct seeking of this, it carries out the monitor of the truck error signal, applying offset to a focal error signal, holds the offset value of a focal error signal in the place where the amplitude of a truck error signal serves as max, and performs a truck count. thereby, the precision of a truck count is markedly alike and improves.

[0023]

[Effect of the Invention] Since it is made for the optical spot to a record-medium top to turn into an ellipse spot which has a minor axis in the direction of a truck at the time of reading of information according to this invention as stated above even if astigmatism is in the optical spot on a record-medium side Since it is made to become the ellipse spot to which the resolution of an information pit does not fall and the optical spot to a record-medium top has a major axis in the direction of a truck at the time of record elimination, the optical pickup equipment which does not need excessive optical power can be offered.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram of the optical pickup equipment of this invention.
[Drawing 2] It is an explanatory view when the major axis of the optical spot of astigmatism is located in the direction of a truck of a record medium.
[Drawing 3] It is the explanatory view showing the physical relationship of an optical spot with astigmatism, and the truck of a record medium.
[Drawing 4] It is the explanatory view showing the magnitude of the truck error signal amplitude in the case of being in each physical relationship of drawing 3 .
[Drawing 5] It is the explanatory view showing the relation between the record medium 6, the objective lens 5 and the truck rectangular cross direction beam 8 at the time of informational record elimination, and the direction beam 9 of a truck.
[Drawing 6] It is an explanatory view when the minor axis of the optical spot of astigmatism is located in the direction of a truck of a record medium.
[Drawing 7] It is the explanatory view showing the magnitude of the PURIPITTO signal amplitude in the case of being in each physical relationship of drawing 3 .
[Drawing 8] It is the explanatory view showing the magnitude of the data signal amplitude in the case of being in each physical relationship of drawing 3 .
[Drawing 9] It is the explanatory view showing the relation between the record medium 6, the objective lens 5 and the truck rectangular cross direction beam 8 at the time of informational record playback, and the direction beam 9 of a truck.
[Drawing 10] It is the block diagram of the conventional optical pickup equipment which does not have the beam plastic surgery means.
[Drawing 11] It is the explanatory view of a light beam in case the light source is semiconductor laser.
[Drawing 12] It is an explanatory view at the time of information record when the minor axis of the optical spot of astigmatism is located in the direction of a truck of a record medium.
[Drawing 13] It is the explanatory view of a beam plastic surgery means.
[Drawing 14] It is the explanatory view of astigmatism.
[Description of Notations]
1 Light Source
2 Collimate Lens
3 Beam Splitter
4 Deviation BURIZUMU
5 Objective Lens
6 Record Medium
7 Prism
8 The Truck Rectangular Cross Direction Beam
9 The Direction Beam of Truck

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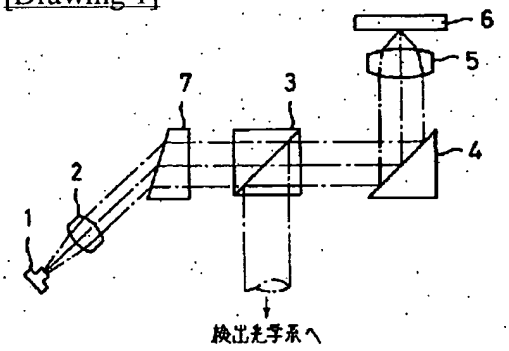
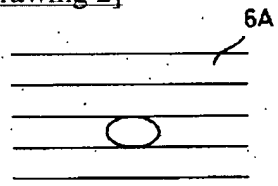
DRAWINGS

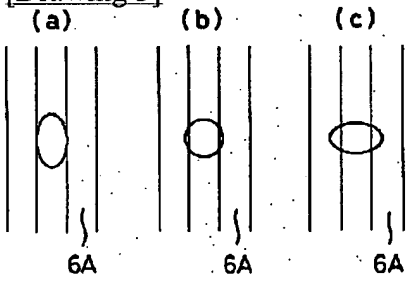
[Drawing 1]



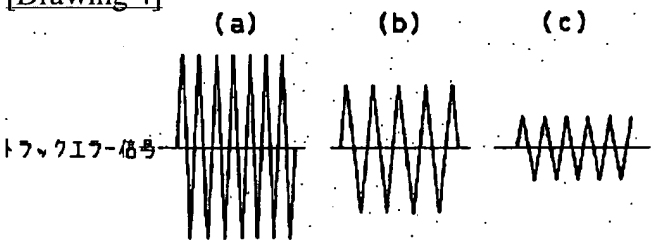
[Drawing 2]



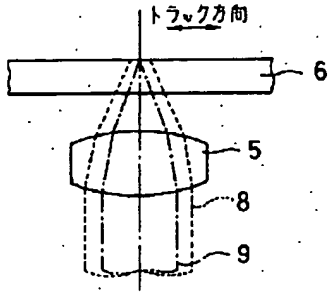
[Drawing 3]



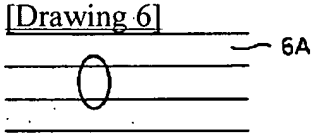
[Drawing 4]



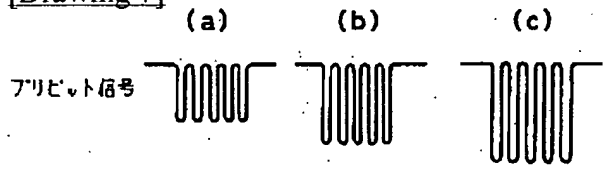
[Drawing 5]



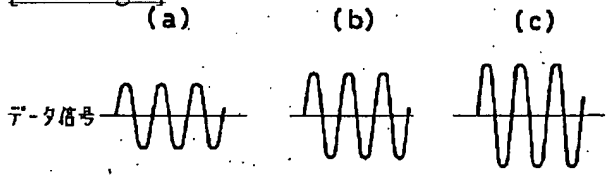
[Drawing 6]



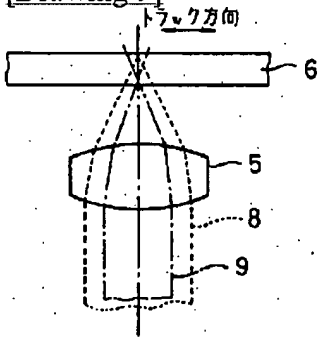
[Drawing 7]



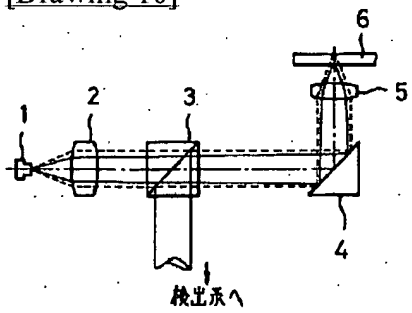
[Drawing 8]



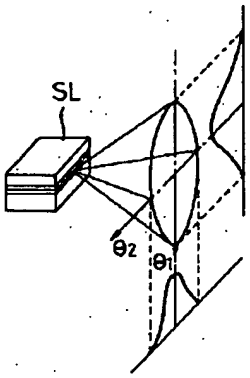
[Drawing 9]



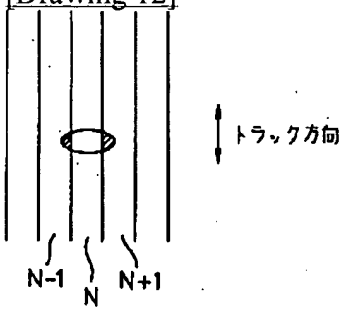
[Drawing 10]



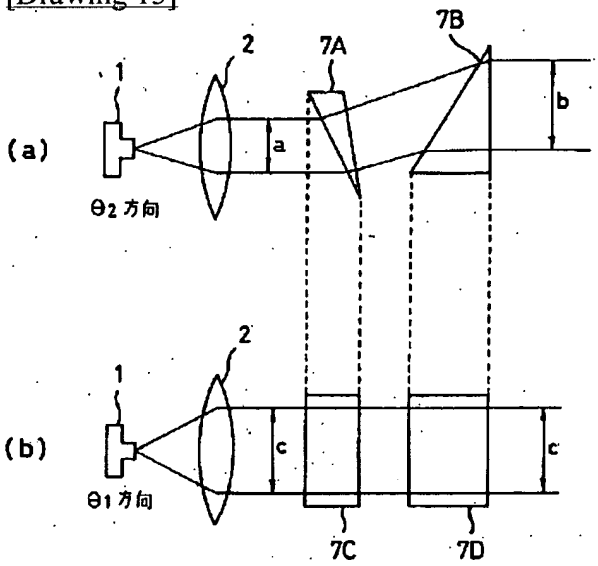
[Drawing 11]



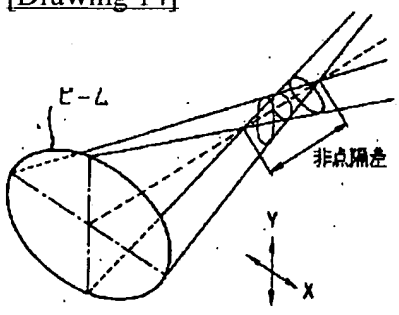
[Drawing 12]



[Drawing 13]



[Drawing 14]



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CORRECTION OR AMENDMENT

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[FI]

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7/125 B

[Procedure revision]
[Filing Date] December 20, Heisei 11 (1999. 12.20)
[Procedure amendment 1]
[Document to be Amended] Specification
[Item(s) to be Amended] Claim
[Method of Amendment] Modification
[Proposed Amendment]
[Claim(s)]
[Claim 1] A beam plastic surgery means to operate the light beam from the light source orthopedically, and the condensing optical system for condensing to the record medium which can rewrite the light beam which passed through this beam plastic surgery means, An optical separation means to separate the reflected light in said record medium which received the light beam from this condensing optical system, and the light beam from said light source, The detection optical system which detects the information recorded on said record medium based on the reflected light separated here, At the time of record elimination of the information on said record medium, so that the optical spot to said record-medium top may turn into an ellipse spot which has a major axis in the direction of a truck It is optical pickup equipment characterized by having the focal control means which is controlled and is controlled to become the ellipse spot to which the optical spot to said record-medium top has a minor axis in the direction of a truck at the time of playback of the information on said record medium.
[Claim 2] It is optical pickup equipment according to claim 1 which carries out focal control at the time of record elimination of the information on said record medium so that the amplitude of a truck error

signal may serve as max by said focal control means, and is characterized by carrying out focal control of the time of playback of the information on said record medium so that the amplitude of a PURIPITTO signal or a data signal may serve as max by said focal control means.
[Claim 3] Optical pickup equipment characterized by providing the following. A beam plastic surgery means to operate the light beam from the light source orthopedically Condensing optical system for condensing to the record medium which can rewrite the light beam which passed through this beam plastic surgery means An optical separation means to separate the reflected light in said record medium which received the light beam from this condensing optical system, and the light beam from said light source The focal control means controlled so that the optical spot on said record medium turns into an ellipse spot which has a major axis in the direction of a truck at the time of direct seeking of the detection optical system which detects the information recorded on said record medium based on the reflected light separated here, and said condensing optical system
[Claim 4] Optical pickup equipment according to claim 3 characterized by carrying out focal control so that the amplitude of a truck error signal may serve as max by said focal control means.
[Procedure amendment 2]
[Document to be Amended] Specification
[Item(s) to be Amended] 0002
[Method of Amendment] Modification
[Proposed Amendment]
[0002]
[Description of the Prior Art] As shown in drawing 10, the optical pickup equipment which writes in or reads information to a record medium makes parallel light the light beam from the light source 1 with a collimate lens 2, and is irradiating the record medium 6 through a beam splitter 3, a polarizing prism 4, and an objective lens 5. Generally as the light source in this case, semiconductor laser is used.
[Procedure amendment 3]
[Document to be Amended] Specification
[Item(s) to be Amended] 0016
[Method of Amendment] Modification
[Proposed Amendment]
[0016] Next, drawing 3 shows the relation of an optical spot and truck 6A of a record medium 6 with astigmatism, and as for drawing 3 <b>, drawing 3 <a> shows the case where, as for drawing 3 <c>, the minor axis of an optical spot is located in the direction of a truck when an optical spot is circular, respectively, when the major axis of an optical spot is located in the direction of a truck. and drawing 4 -- <a><b <c>> -- drawing 3 -- the magnitude of the amplitude of each truck error signal of <a><b <c>> which carried out optical spot location ****** is shown. When an optical spot is able to extract in the truck rectangular cross direction most so that drawing 3 and drawing 4 may show (i.e., when the major axis of an ellipse spot becomes in the direction of a truck), the amplitude of a truck error signal serves as max.
[Procedure amendment 4]
[Document to be Amended] Specification
[Item(s) to be Amended] 0017
[Method of Amendment] Modification
[Proposed Amendment]
[0017] Therefore, before carrying out record elimination of the information at a record medium 6, the monitor of the truck error signal is carried out applying offset to a focal error signal, the offset value of a focal error signal is held in the place where the amplitude of a truck error signal serves as max, and record elimination is performed in the state of the focus. The relation between the record medium 6 in this case, an objective lens 5 and the truck rectangular cross direction beam 8, and the direction beam 9 of a truck comes to be shown in drawing 5.

[Translation done.]

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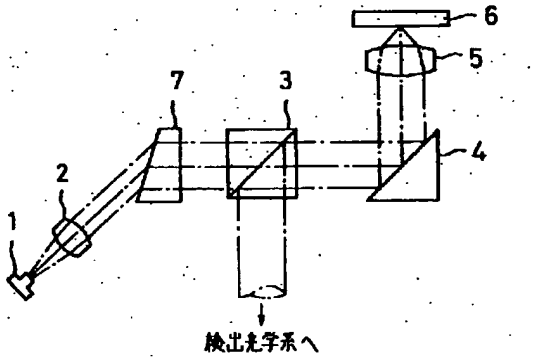
(54)【発明の名称】　光ピックアップ装置

(57)【要約】

【構成】　光源からの光ビームを整形するビーム整形手段を経た光ビームを書き換え可能な記録媒体に集光するための集光光学系と、この集光光学系からの光ビームを受けた記録媒体での反射光に基づいて記録媒体に記録された情報を検出する検出光学系と、記録媒体への情報の記録消去時は記録媒体上への光スポットがトラック方向に長軸を有する楕円スポットとなるように制御し、一方、記録媒体への情報の再生時は記録媒体上への光スポットがトラック方向に短軸を有する楕円スポットとなるように制御するフォーカス制御手段とから構成される。

【効果】　記録媒体面上の光スポットに非点収差があっても、情報再生時には情報ピットの分解能が低下せず、また、記録消去時には余分な光パワーを必要としない。



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【特許請求の範囲】

【請求項1】　光源からの光ビームを整形するビーム整形手段と、このビーム整形手段を経た光ビームを書き換え可能な記憶媒体に集光するための集光光学系と、この集光光学系からの光ビームを受けた前記記録媒体での反射光と前記光源からの光ビームとを分離する光分離手段と、ここで分離された反射光に基づいて前記記憶媒体に記録された情報を検出する検出光学系と、前記記録媒体への情報の記憶消去時は前記記録媒体上への光スポットがトラック方向に長軸を有する楕円スポットとなるように制御し前記記憶媒体への情報の再生時は前記記録媒体上への光スポットがトラック方向に短軸を有する楕円スポットとなるように制御するフォーカス制御手段とを備えたことを特徴とする光ピックアップ装置。

【請求項2】　前記記録媒体への情報の記憶消去時は前記フォーカス制御手段でトラックエラー信号の振幅が最大となるようにフォーカス制御し前記記録媒体への情報の再生時は前記フォーカス制御手段でプリピット信号あるいはデータ信号の振幅が最大となるようにフォーカス制御するようにしたことを特徴とする請求項1記載の光ピックアップ装置。

【請求項3】　光源からの光ビームを整形するビーム整形手段と、このビーム整形手段を経た光ビームを書き換え可能な記録媒体に集光するための集光光学系と、この集光光学系からの光ビームを受けた前記記録媒体での反射光と前記光源からの光ビームとを分離する光分離手段と、ここで分離された反射光に基づいて前記記録媒体に記録された情報を検出する検出光学系と、前記集光光学系のダイレクトシーク時には前記記録媒体上の光スポットがトラック方向に長軸を有する楕円スポットとなるように制御するフォーカス制御手段とを備えたことを特徴とする光ピックアップ装置。

【請求項4】　前記フォーカス制御手段でトラックエラー信号の振幅が最大となるようにフォーカス制御するようにしたことを特徴とする請求項3記載の光ピックアップ装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、半導体レーザを光源として用いた光ピックアップ装置に関する。

【０００２】

【従来の技術】記憶媒体に情報を書込んだり読み出したりする光ピックアップ装置は、図１０に示すように、光源１からの光ビームをコリメートレンズ２で平行光にし、ビームスプリッタ３、偏向プリズム４、および対物レンズ５を介して記録媒体６に照射している。この場合の光源として、一般に、半導体レーザが用いられている。

【０００３】このような光源１としての半導体レーザＳ

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Lは、図１１に示すように接合部に対して、垂直な方向θ_1と水平な方向θ_2とで出射する光ビームの広がり角度が異なり、垂直な方向θ_1が長軸で水平な方向θ_2が短軸の楕円ビームとなる。したがって、この光ビームを図１０に示すような一般的な光ピックアップ装置で集光すると、記録媒体６上の光スポットも楕円スポットとなる。

【０００４】楕円スポットの長軸が記録媒体６のトラック方向に一致した場合は、情報ピットに対する分解能の低下を招き、精度良く情報を読み取れない。また、楕円スポットの短軸がトラック方向と一致すると、たとえば図１２に示すように第Ｎトラックにデータを記録しようとした場合、第Ｎ－１トラックや第Ｎ＋１とラックまで光スポットが達してしまい、記録に関係のないこれら第Ｎ－１トラックや第Ｎ＋１トラックにまで光ビームを照射することになり、余分な光パワーを必要とする。

【０００５】そこで、これを避けるために一般には、楕円ビームを円形ビームに整形するビーム整形を行う。その一例を図１３に示す。図１３の（ａ）は光ビームの水平な方向の整形を示し、図１３の（ｂ）は垂直な方向の整形を示す。光ビームの水平方θ_2は、図１３の（ａ）に示すように光源１からコリメートレンズ２を介して得られた光ビームを２個のプリズム７Ａ，７Ｂにより平行光ビームの径ａを径ｂに拡大する。このときビーム整形倍率は、Ａ＝ｂ／ａとなる。一方、図１３の（ｂ）に示すように垂直方向の平行光ビームはプリズム７Ｃ，７Ｄを直進しプリズム７Ｃ，７Ｄの前後で平行光ビームの径ｃは変わらない。ビーム整形の倍率は、ｂ＝ｃとなるように決定される。ビーム整形を行った光学系の記録媒体６上の面スポットは、このようにして、その調整が適性であれば、円形スポットが得られる。

【０００６】

【発明が解決しようとする課題】ところが、ビーム整形の際の調整がずれると、以下に述べるような不具合が発生する。いま、ビーム整形の倍率をＡとすると、コリメートレンズ２の焦点距離ｆｃは、水平方向の焦点距離がＡ＊ｆｃになったと等価になる。垂直方向の焦点距離はｆｃのままである。したがって、光源１とコリメートレンズ２との間隔が適正な値からずれると、図１４に示すように非点隔差を生じ光スポットに非点収差が発生することになる。ここで、非点隔差とは、ｘ方向に最も絞れた位置とｙ方向に最も絞れた位置との間隔をいう。光源１とコリメートレンズ２とのずれに対する記録媒体６上面の光スポットの非点収差の値を表１に示す。この表では、コリメートレンズ２の焦点距離を８ｍｍビーム整形倍率を２．３倍、対物レンズの焦点距離を４ｍｍとした場合を示している。

【０００７】

【表１】

3　　4

光源とコリメートレンズの間隔の適正値からのずれ（μm）	0	2	4	6	8	10
ディスク上の非点隔差量（μm）	0	0.41	0.811	1.22	1.622	2.03

【0008】これからもわかるとおり、光源1とコリメートレンズ2との間隔が数μmずれただけで記録媒体6上には、0.5～1.5μmの非点隔差が生じる。つまり、光源1とコリメートレンズ2との間隔がずれると、記録媒体6上の光スポットには非点収差が発生し、その発生方向はトラック方向であるため、情報ピットに対する分解能の低下を招き、精度良く情報を読み取ることができなくなる。光源1とコリメートレンズ2との間隔のずれは、経時変化や環境温度変化等で必ず生じるものである。

【0009】したがって、本発明の目的は、記録媒体面上の光スポットに非点収差があっても、情報の再生時には情報ピットの分解能が低下せず、かつ記録消去時には余分な光パワーを必要としない光ピックアップ装置を提供するものである。

【0010】

【課題を解決するための手段】本発明の光ピックアップ装置は、光源からの光ビームを整形するビーム整形手段と、このビーム整形手段を経た光ビームを書き換え可能な記録媒体に集光するための集光光学系と、この集光光学系からの光ビームを受けた記録媒体での反射光と光源からの光ビームとを分離する光分離手段と、ここで分離された反射光に基づいて記録媒体に記録された情報を検出する検出光学系と、記録媒体への情報の記録消去時は記録媒体上への光スポットがトラック方向に長軸を有する楕円スポットとなるように制御する一方、記録媒体への情報の再生時は記録媒体上への光スポットがトラック方向に短軸を有する楕円スポットとなるように制御するフォーカス制御手段とを備える。

【0011】

【作用】本発明の光ピックアップ装置では、記録媒体への情報の記録消去時は、光源からの光パワーを有効に利用できるように、記録媒体上への光スポットがトラック方向に長軸を有する楕円スポットとなるように制御し、一方、記録媒体への情報の再生時は、読み出すデータの精度を高めるために、記録媒体上への光スポットがトラック方向に短軸を有する楕円スポットとなるように制御する。これにより、記録媒体面上に非点収差があっても、情報の読み取り時には情報ピットの分解能が低下せず、また、記録消去時には余分な光源出力を必要とせず、効率の良いデータの記録、再生、消去が行われる。

【0012】

【実施例】以下、本発明の一実施例を説明する。図1＊は、本発明の光ピックアップ装置の構成図を示すものである。まず、光源1から出た光ビームは、コリメートレンズ2で平行光とされる。平行光とされた光ビームは、ビーム整形手段であるビーム整形プリズム7で平行ビーム断面形状を円形に整形される。そして、光分離手段であるビームプリッタ3を通過し、集光光学系の偏向プリズム4に入力される。偏向プリズム4では光路をほぼ直角に曲げられ、対物レンズ5で書換え可能記録媒体6の記録面上に照射される。記録媒体6面上では直径が約1μmの円になるような光スポットを形成する。

【0013】そして、記録媒体6を反射した光ビームは、対物レンズ5を通り再び平行光となり、偏向プリズム4で反射しビームプリッタ3で反射して、情報信号、トラックエラー信号、フォーカス信号、フォーカスエラー信号等の検出光学系に至る。すなわち、光分離手段であるビームスプリッタ3で記録媒体6での反射光と光源1からの光ビームとを分離し、記録媒体に記憶された情報を検出する検出光学系に記録媒体6からの反射光を入力する。

【0014】ここで、ビーム整形を用いた光学系では、前述したように光源1とコリメートレンズ2との間隔のずれは、経時変化や環境温度により必ず生じるので、本発明では、この間隔のずれによる媒体6上のスポットの非点収差による影響を防止するため、フォーカス制御手段で以下のような制御を行う。

【0015】非点収差のある光スポットに対しては、記録媒体6への情報の記録消去時は、図2に示すように、記録媒体6上への光スポットがトラック方向に長軸を有する楕円スポットとなるように制御する。こうすることにより、記録媒体6にデータを記録消去する際に隣接するトラックに余分な光を照射することがなくなり、光源1からの光ビームを効率良く利用できる。

【0016】次に、図3は非点収差のある光スポットと記録媒体6のトラック6Aとの関係を示すもので、図3〈a〉は光スポットの長軸がトラック方向に位置している場合、図3〈b〉は光スポットの長軸および短軸がトラック方向に対して少しずれて位置している場合、図3〈c〉は光スポットの短軸がトラック方向に位置している場合をそれぞれ示している。そして、図4〈a〉〈b〉〈c〉は、図3〈a〉〈b〉〈c〉のそれぞれの光スポット位置い対応したトラックエラー信号の振幅の大きさを示すものである。図3および図4からわかるように、光スポットがトラック直交方向にもっとも絞れた

とき、つまり、楕円スポットの長軸がトラック方向になったときにトラックエラー信号の振幅が最大となる。

【0017】よって、情報を記録媒体6に記録消去する前に、フォーカスエラー信号にオフセットをかけながらトラックエラー信号をモニタし、トラックエラー信号の振幅が最大となるところでフォーカスエラー信号のオフセット値を保持し、そのフォーカス状態で記録消去を行う。この場合の記録媒体6と対物レンズ5およびトラック直交方向ビーム8とトラック方向ビーム9の関係な図5に示すようになる。

【0018】一方、非点収差のある光スポットに対して、記録媒体6の情報の再生時は、図6に示すように、記録媒体6上への光スポットがトラック方向に短軸を有する楕円スポットとなるように制御する。こうすることにより、記録媒体6の情報を再生する場合に、情報ピットの分解能が向上し精度良く情報の再生が可能となる。

【0019】次に図7〈a〉〈b〉〈c〉は、図3〈a〉〈b〉〈c〉のそれぞれの非点収差のある光スポットに対応したプリピット信号の振幅の大きさを示し、同様に、図8〈a〉〈b〉〈c〉は、図3〈a〉〈b〉〈c〉のそれぞれの非点収差のある光スポットに対応したデータ信号の振幅の大きさを示す。

【0020】これらの図からわかるように、光スポットがトラック方向に最も絞れたとき、つまり、楕円スポットの短軸がトラック方向になったときにプリピット信号やデータ信号の振幅が最大となる。

【0021】よって、情報を記録媒体6に記録消去する前に、フォーカスエラー信号にオフセットをかけながらプリピット信号やデータ信号をモニタし、プリピット信号やデータ信号の振幅が最大となるところでフォーカスエラー信号のオフセット値を保持し、そのフォーカス状態で記録再生を行う。この場合の記録媒体6と対物レンズ5およびトラック直交方向ビーム8とトラック方向ビーム9の関係は図9に示すようになる。

【0022】また、記録媒体6の記録再生すべきトラックに対物レンズ5を移動させる場合、すなわち、集光光学系のダイレクトシーク時には、記録媒体6上の光スポットがトラック方向に長軸を有する楕円スポットとなるように制御する。これは、ダイレクトシークする前に、フォーカスエラー信号にオフセットをかけながらトラックエラー信号をモニタし、トラックエラー信号の振幅が最大となるところでフォーカスエラー信号のオフセット値を保持し、トラックカウントを行う。これにより、トラックカウントの精度が格段に向上する。

【0023】

【発明の効果】以上述べたように、本発明によれば、記録媒体面上の光スポットに非点収差があっても、情報の

読み取り時には記録媒体上への光スポットがトラック方向に短軸を有する楕円スポットとなるようにするので、情報ピットの分解能が低下せず、また、記録消去時には記録媒体上への光スポットがトラック方向に長軸を有する楕円スポットとなるようにするので、余分な光パワーを必要としない光ピックアップ装置を提供することができる。

【図面の簡単な説明】

【図1】本発明の光ピックアップ装置の構成図である。

【図2】非点収差の光スポットの長軸が記録媒体のトラック方向に位置した場合の説明図である。

【図3】非点収差のある光スポットと記録媒体のトラックとの位置関係を示す説明図である。

【図4】図3のそれぞれの位置関係にある場合のトラックエラー信号振幅の大きさを示す説明図である。

【図5】情報の記録消去時における記録媒体6と対物レンズ5およびトラック直交方向ビーム8とトラック方向ビーム9の関係を示す説明図である。

【図6】非点収差の光スポットの短軸が記録媒体のトラック方向に位置した場合の説明図である。

【図7】図3のそれぞれの位置関係にある場合のプリピット信号振幅の大きさを示す説明図である。

【図8】図3のそれぞれの位置関係にある場合のデータ信号振幅の大きさを示す説明図である。

【図9】情報の記録再生時における記録媒体6と対物レンズ5およびトラック直交方向ビーム8とトラック方向ビーム9の関係を示す説明図である。

【図10】ビーム整形手段を有していない従来の光ピックアップ装置の構成図である。

【図11】光源が半導体レーザである場合の光ビームの説明図である。

【図12】非点収差の光スポットの短軸が記録媒体のトラック方向に位置した場合の情報記録時の説明図である。

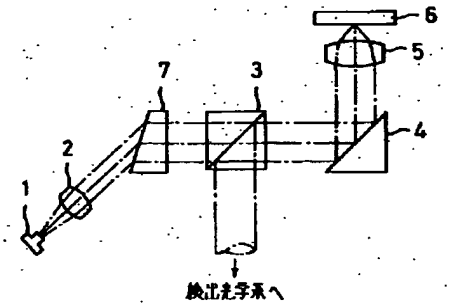
【図13】ビーム整形手段の説明図である。

【図14】非点収差の説明図である。

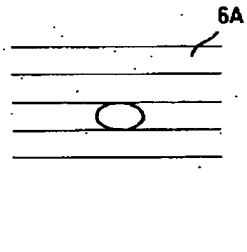
【符号の説明】

1　光源
2　コリメートレンズ
3　ビームスプリッタ
4　偏向プリズム
5　対物レンズ
6　記録媒体
7　プリズム
8　トラック直交方向ビーム
9　トラック方向ビーム

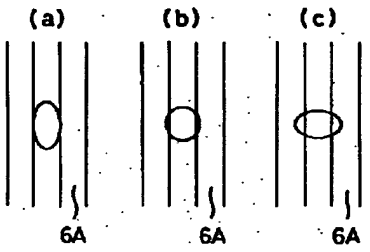
【図1】



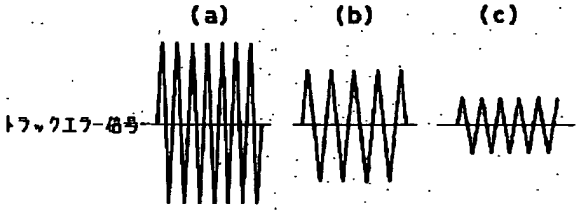
【図2】



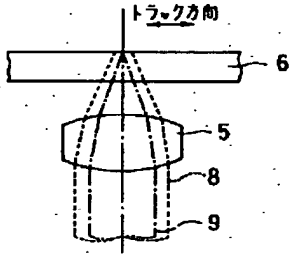
【図3】



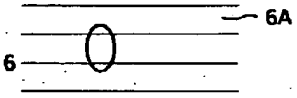
【図4】



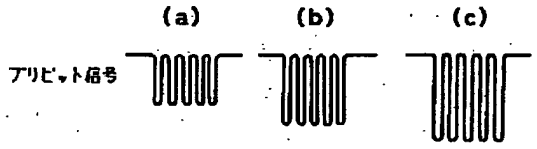
【図5】



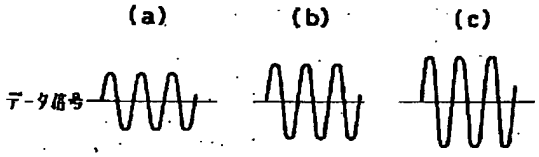
【図6】



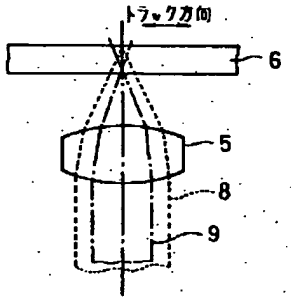
【図7】



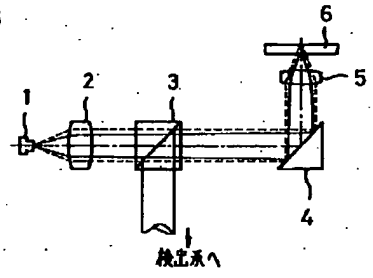
【図8】



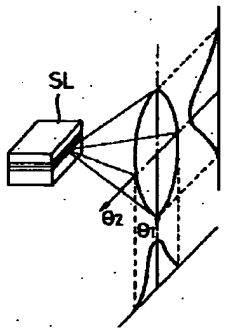
【図9】



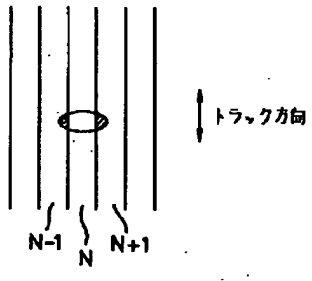
【図10】



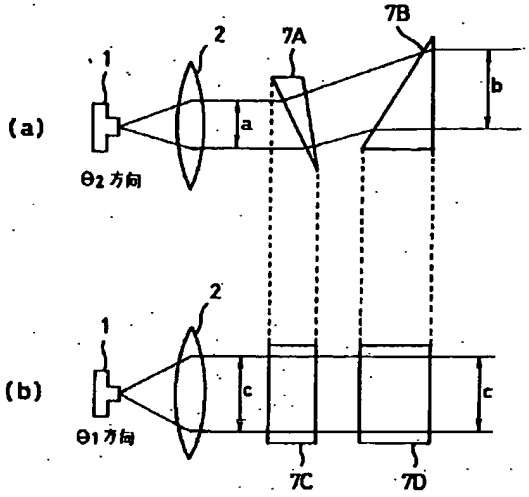
【図11】



【図12】



【図13】



【図14】